

Sources of inorganic carbon
transported by rivers in an active
volcanic zone, North Eastern China

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Major elements and carbon isotopes of dissolved inorganic carbon (DIC) have been measured in waters from the Changbaishan mountain, a volcanic area in North Eastern China, during the period between June and September 2016 to decipher the origin of CO₂ involved in chemical weathering reactions.

At a first order, spatial variations of major elements ratios measured in water samples can be explained by a change of the chemical composition of the volcanic rocks between the volcanic cone (trachytes) and the basaltic shield as evidenced by the variations of composition of these rocks. Hence, DIC results from the neutralization of CO₂ by silicate rocks. At a first order, the DIC transported by rivers is derived from the consumption by chemical weathering of CO₂ with a magmatic origin, enriched in ¹³C ($\delta^{13}\text{C} \approx -5\text{‰}$) and biogenic soil CO₂ with lower isotopic compositions ($-20\text{‰} < \delta^{13}\text{C} < -15\text{‰}$). The highest $\delta^{13}\text{C}$ values probably result from C isotopes fractionation during CO₂ degassing in rivers. A mass balance based on carbon isotopes suggest that the contribution of magmatic CO₂ vary from less than 20% to more than 70%. Effects of degassing are a source of uncertainty and might result in an overestimation of the contribution of magmatic CO₂.

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